

PyPalEx

1.3.3

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<b>1 PyPalEx: The Python Palette Extractor</b>	<b>1</b>
1.1 Description	1
<b>2 Namespace Index</b>	<b>1</b>
2.1 Package List	1
<b>3 Class Index</b>	<b>2</b>
3.1 Class List	2
<b>4 File Index</b>	<b>2</b>
4.1 File List	2
<b>5 Namespace Documentation</b>	<b>3</b>
5.1 pypalex Namespace Reference	3
5.1.1 Detailed Description	3
5.2 pypalex.__main__ Namespace Reference	3
5.2.1 Function Documentation	4
5.2.2 Variable Documentation	6
5.3 pypalex.arg_messages Namespace Reference	8
5.3.1 Function Documentation	8
5.4 pypalex.constants Namespace Reference	9
5.4.1 Variable Documentation	9
5.5 pypalex.conversion_utils Namespace Reference	13
5.5.1 Function Documentation	13
5.6 pypalex.extraction_utils Namespace Reference	15
5.6.1 Function Documentation	15
5.7 pypalex.Extractor Namespace Reference	22
5.8 pypalex.file_utils Namespace Reference	22
5.8.1 Function Documentation	22
5.9 pypalex.image_utils Namespace Reference	23
5.9.1 Function Documentation	23
5.10 pypalex.print_utils Namespace Reference	24
5.10.1 Function Documentation	25
<b>6 Class Documentation</b>	<b>27</b>
6.1 Extractor Class Reference	27
6.1.1 Detailed Description	28
6.1.2 Constructor & Destructor Documentation	28
6.1.3 Member Function Documentation	28
6.1.4 Member Data Documentation	30
<b>7 File Documentation</b>	<b>32</b>
7.1 __main__.py File Reference	32
7.1.1 Detailed Description	33

7.1.2 Author(s) . . . . .	33
7.2 <a href="#">arg_messages.py</a> File Reference . . . . .	34
7.2.1 Detailed Description . . . . .	34
7.2.2 Author(s) . . . . .	34
7.3 <a href="#">constants.py</a> File Reference . . . . .	34
7.3.1 Detailed Description . . . . .	35
7.3.2 Author(s) . . . . .	35
7.4 <a href="#">conversion_utils.py</a> File Reference . . . . .	36
7.4.1 Detailed Description . . . . .	36
7.4.2 Author(s) . . . . .	36
7.5 <a href="#">extraction_utils.py</a> File Reference . . . . .	36
7.5.1 Detailed Description . . . . .	37
7.5.2 Author(s) . . . . .	37
7.6 <a href="#">Extractor.py</a> File Reference . . . . .	38
7.6.1 Detailed Description . . . . .	38
7.6.2 Author(s) . . . . .	38
7.7 <a href="#">file_utils.py</a> File Reference . . . . .	38
7.7.1 Detailed Description . . . . .	39
7.7.2 Author(s) . . . . .	39
7.8 <a href="#">image_utils.py</a> File Reference . . . . .	39
7.8.1 Detailed Description . . . . .	39
7.8.2 Author(s) . . . . .	39
7.9 <a href="#">print_utils.py</a> File Reference . . . . .	40
7.9.1 Detailed Description . . . . .	40
7.9.2 Author(s) . . . . .	40
<b>Index</b>	<b>41</b>

# 1 PayPalEx: The Python Palette Extractor

## 1.1 Description

PayPalEx is a tool for extracting color palettes from images and generating a JSON format file with light and dark color themes. This tool is intended to be OS independent, for use by the tech community for developing their own custom theme managers or by artists who want to extract color palettes for their art from images, pictures or wallpapers they adore.

## 2 Namespace Index

### 2.1 Package List

Here are the packages with brief descriptions (if available):

<a href="#">pypalex</a>	
Python Palette <a href="#">Extractor</a> : extracts color palettes from images	3
<a href="#">pypalex.__main__</a>	3
<a href="#">pypalex.arg_messages</a>	8
<a href="#">pypalex.constants</a>	9
<a href="#">pypalex.conversion_utils</a>	13
<a href="#">pypalex.extraction_utils</a>	15
<a href="#">pypalex.Extractor</a>	22
<a href="#">pypalex.file_utils</a>	22
<a href="#">pypalex.image_utils</a>	23
<a href="#">pypalex.print_utils</a>	24

## 3 Class Index

### 3.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

<a href="#">Extractor</a>	
Extracts colors given a matrix of HSV values extracted from an image	27

## 4 File Index

### 4.1 File List

Here is a list of all files with brief descriptions:

<a href="#">__main__.py</a>	
Main script for PyPalEx	32
<a href="#">arg_messages.py</a>	
Archive of messages to display for arguments supplied by user	34
<a href="#">constants.py</a>	
A collection of constants for PyPalEx	34
<a href="#">conversion_utils.py</a>	
Utilities for converting between RGB, HSV, HEX	36
<a href="#">extraction_utils.py</a>	
Utilities for extracting colors from the image	36
<a href="#">Extractor.py</a>	
Extraction utility class for extracting colors from the image	38

<a href="#">file_utils.py</a>	
Utilities for file handling	38
<a href="#">image_utils.py</a>	
Utilities for processing image and file handling	39
<a href="#">print_utils.py</a>	
Utilities for printing preview to the screen	40

## 5 Namespace Documentation

### 5.1 pypalex Namespace Reference

Python Palette [Extractor](#): extracts color palettes from images.

#### Namespaces

- namespace [\\_\\_main\\_\\_](#)
- namespace [arg\\_messages](#)
- namespace [constants](#)
- namespace [conversion\\_utils](#)
- namespace [extraction\\_utils](#)
- namespace [Extractor](#)
- namespace [file\\_utils](#)
- namespace [image\\_utils](#)
- namespace [print\\_utils](#)

#### 5.1.1 Detailed Description

Python Palette [Extractor](#): extracts color palettes from images.

PyPalEx is a tool for extracting color palettes from images and generating a JSON format file with light and dark color themes. This tool is intended to be OS independent, for use by the tech community for developing their own custom theme managers or by artists who want to extract color palettes for their art from images, pictures or wallpapers they adore.

### 5.2 pypalex.\_\_main\_\_ Namespace Reference

#### Functions

- def [main](#) ()  
*Main script function.*
- def [handle\\_args](#) ()  
*Handles the arguments passed to PyPalEx.*
- def [extract\\_color\\_palettes](#) ()  
*Handles color extraction from image(s).*
- def [setup\\_argument\\_parser](#) ()  
*Sets up the argument parser for command line arguments.*
- def [check\\_sources](#) (filepaths, path=None)  
*Checks each of the sources provided and removes any bad sources.*
- def [check\\_path](#) (path)  
*Check the path to make sure it exists.*
- def [set\\_global\\_args](#) (args)  
*Sets the global variables using the arguments.*
- def [check\\_source](#) (filepath)  
*Checks to make sure the path leads to a file.*

## Variables

- list `EXTRACTORS` = []  
*List of `Extractor` class objects for each individual image.*
- list `PROPER_IMAGES` = []  
*List of real/existing image file path(s).*
- list `FILENAMES` = []  
*List of image filenames.*
- list `OUTPUT_FILEPATHS` = []  
*List of output file path(s) for each image.*
- string `OUTPUT_PATH` = "  
*The path to the output directory where all JSON files will be saved.*
- string `OUTPUT_TAIL` = "-color\_palette.json"  
*The tail to append to each output filepath.*
- bool `SAVE_CHECK` = False  
*Flag to check if user wants to save extracted color palettes.*
- bool `SHOW_PREVIEW` = False  
*Flag to show a preview of extracted palettes.*
- bool `PASTEL_L` = False  
*Flag to convert light color palette to pastel.*
- bool `PASTEL_N` = False  
*Flag to convert normal color palette to pastel.*
- bool `PASTEL_D` = False  
*Flag to convert dark color palette to pastel.*
- bool `SAT_PREF_L` = False  
*Flag that gives preference to more saturated colors of the light color palette.*
- bool `SAT_PREF_N` = False  
*Flag that gives preference to more saturated colors of the normal color palette.*
- bool `SAT_PREF_D` = False  
*Flag that gives preference to more saturated colors of the dark color palette.*

### 5.2.1 Function Documentation

**5.2.1.1 `check_path()`** `def check_path (`  
`path` )

Check the path to make sure it exists.

#### Parameters

<code>path</code>	The path to a directory.
-------------------	--------------------------

#### Returns

True if the path exists and is not a file, False otherwise.

**5.2.1.2 check\_source()** `def check_source (`  
    `filepath )`

Checks to make sure the path leads to a file.

#### Parameters

<i>filepath</i>	Path to file with filename and file extension.
-----------------	--

#### Returns

True if file exists, False otherwise.

**5.2.1.3 check\_sources()** `def check_sources (`  
    `filepaths,`  
    `path = None )`

Checks each of the sources provided and removes any bad sources.

Any filepaths or source files that are not images or do not exist get removed.

#### Parameters

<i>filepaths</i>	List of file paths.
<i>path</i>	A path to the images, if it is provided.

#### Returns

True if all/some sources are good, False if all sources are bad.

**5.2.1.4 extract\_color\_palettes()** `def extract_color_palettes ( )`

Handles color extraction from image(s).

**5.2.1.5 handle\_args()** `def handle_args ( )`

Handles the arguments passed to PyPalEx.

**5.2.1.6 main()** `def main ( )`

Main script function.

**5.2.1.7 set\_global\_args()** `def set_global_args (`  
    `args )`

Sets the global variables using the arguments.

**Parameters**

<i>args</i>	User-supplied arguments.
-------------	--------------------------

**5.2.1.8 setup\_argument\_parser()** `def setup_argument_parser ( )`

Sets up the argument parser for command line arguments.

**Returns**

A command line argument parsing object.

**5.2.2 Variable Documentation****5.2.2.1 EXTRACTORS** `list EXTRACTORS = [ ]`

List of [Extractor](#) class objects for each individual image.

**5.2.2.2 FILENAMES** `list FILENAMES = [ ]`

List of image filenames.

**5.2.2.3 OUTPUT\_FILEPATHS** `list OUTPUT_FILEPATHS = [ ]`

List of output file path(s) for each image.

**5.2.2.4 OUTPUT\_PATH** `string OUTPUT_PATH = ''`

The path to the output directory where all JSON files will be saved.

**5.2.2.5 OUTPUT\_TAIL** `string OUTPUT_TAIL = "-color_palette.json"`

The tail to append to each output filepath.



**5.2.2.6 PASTEL\_D** `bool PASTEL_D = False`

Flag to convert dark color palette to pastel.

**5.2.2.7 PASTEL\_L** `bool PASTEL_L = False`

Flag to convert light color palette to pastel.

**5.2.2.8 PASTEL\_N** `bool PASTEL_N = False`

Flag to convert normal color palette to pastel.

**5.2.2.9 PROPER\_IMAGES** `list PROPER_IMAGES = []`

List of real/existing image file path(s).

**5.2.2.10 SAT\_PREF\_D** `bool SAT_PREF_D = False`

Flag that gives preference to more saturated colors of the dark color palette.

**5.2.2.11 SAT\_PREF\_L** `bool SAT_PREF_L = False`

Flag that gives preference to more saturated colors of the light color palette.

**5.2.2.12 SAT\_PREF\_N** `bool SAT_PREF_N = False`

Flag that gives preference to more saturated colors of the normal color palette.

**5.2.2.13 SAVE\_CHECK** `bool SAVE_CHECK = False`

Flag to check if user wants to save extracted color palettes.

#### 5.2.2.14 **SHOW\_PREVIEW** `bool SHOW_PREVIEW = False`

Flag to show a preview of extracted palettes.

## 5.3 **pypalex.arg\_messages** Namespace Reference

### Functions

- def [bad\\_source\\_message](#) ()  
*Generates an error message if the sources provided were not images.*
- def [bad\\_path\\_message](#) ()  
*Generates an error message if the directory provided is not a valid directory.*
- def [no\\_args\\_help\\_message](#) ()  
*Generates a help message if no arguments were presented.*

### 5.3.1 **Function Documentation**

#### 5.3.1.1 **bad\_path\_message()** `def bad_path_message ( )`

Generates an error message if the directory provided is not a valid directory.

##### Returns

The "bad directory" message.

#### 5.3.1.2 **bad\_source\_message()** `def bad_source_message ( )`

Generates an error message if the sources provided were not images.

##### Returns

The "bad sources" message.

#### 5.3.1.3 **no\_args\_help\_message()** `def no_args_help_message ( )`

Generates a help message if no arguments were presented.

##### Returns

The "no arguments" help message.

## 5.4 pypalex.constants Namespace Reference

### Variables

- list [BLACK\\_RGB](#) = [0, 0, 0]
- list [WHITE\\_RGB](#) = [255, 255, 255]
- list [RED\\_RGB](#) = [255, 0, 0]
- list [YELLOW\\_RGB](#) = [255, 234, 0]
- list [GREEN\\_RGB](#) = [0, 255, 0]
- list [CYAN\\_RGB](#) = [0, 255, 255]
- list [BLUE\\_RGB](#) = [0, 0, 255]
- list [MAGENTA\\_RGB](#) = [255, 0, 255]
- int [BLACK\\_HEX](#) = 0x000000
- int [WHITE\\_HEX](#) = 0xFFFFFF
- int [RED\\_HEX](#) = 0xFF0000
- int [YELLOW\\_HEX](#) = 0xFFEA00
- int [GREEN\\_HEX](#) = 0x00FF00
- int [CYAN\\_HEX](#) = 0x00FFFF
- int [BLUE\\_HEX](#) = 0x0000FF
- int [MAGENTA\\_HEX](#) = 0xFF00FF
- int [RED\\_HUE](#) = 0
- int [YELLOW\\_HUE](#) = 55
- int [GREEN\\_HUE](#) = 120
- int [CYAN\\_HUE](#) = 180
- int [BLUE\\_HUE](#) = 240
- int [MAGENTA\\_HUE](#) = 300
- list [RED\\_HUE\\_RANGE\\_MAX](#) = [330, 360]
- list [RED\\_HUE\\_RANGE\\_MIN](#) = [0, 25]
- list [YELLOW\\_HUE\\_RANGE](#) = [25, 64]
- list [GREEN\\_HUE\\_RANGE](#) = [64, 170]
- list [CYAN\\_HUE\\_RANGE](#) = [170, 210]
- list [BLUE\\_HUE\\_RANGE](#) = [210, 260]
- list [MAGENTA\\_HUE\\_RANGE](#) = [260, 330]
- list [BLACK\\_BRIGHTNESS\\_RANGE](#) = [0.0, 50.0]
- list [GRAY\\_BRIGHTNESS\\_RANGE](#) = [50.0, 75.0]
- list [WHITE\\_BRIGHTNESS\\_RANGE](#) = [75.0, 100.0]
- list [SATURATION\\_RANGE](#) = [5.0, 100.0]
- list [BRIGHTNESS\\_RANGE](#) = [25.0, 100.0]
- list [PASTEL\\_SATURATION\\_RANGE](#) = [15.0, 75.0]
- list [PASTEL\\_BRIGHTNESS\\_RANGE](#) = [50.0, 100.0]

### 5.4.1 Variable Documentation

**5.4.1.1 BLACK\_BRIGHTNESS\_RANGE** `list BLACK_BRIGHTNESS_RANGE = [0.0, 50.0]`

**5.4.1.2 BLACK\_HEX** `int BLACK_HEX = 0x000000`

**5.4.1.3 BLACK\_RGB** `list BLACK_RGB = [0, 0, 0]`

**5.4.1.4 BLUE\_HEX** `int BLUE_HEX = 0x0000FF`

**5.4.1.5 BLUE\_HUE** `int BLUE_HUE = 240`

**5.4.1.6 BLUE\_HUE\_RANGE** `list BLUE_HUE_RANGE = [210, 260]`

**5.4.1.7 BLUE\_RGB** `list BLUE_RGB = [0, 0, 255]`

**5.4.1.8 BRIGHTNESS\_RANGE** `list BRIGHTNESS_RANGE = [25.0, 100.0]`

**5.4.1.9 CYAN\_HEX** `int CYAN_HEX = 0x00FFFF`

**5.4.1.10 CYAN\_HUE** `int CYAN_HUE = 180`

**5.4.1.11 CYAN\_HUE\_RANGE** `list CYAN_HUE_RANGE = [170, 210]`

**5.4.1.12 CYAN\_RGB** `list CYAN_RGB = [0, 255, 255]`

**5.4.1.13 GRAY\_BRIGHTNESS\_RANGE** `list GRAY_BRIGHTNESS_RANGE = [50.0, 75.0]`

**5.4.1.14 GREEN\_HEX** `int GREEN_HEX = 0x00FF00`

**5.4.1.15 GREEN\_HUE** `int GREEN_HUE = 120`

**5.4.1.16 GREEN\_HUE\_RANGE** `list GREEN_HUE_RANGE = [64, 170]`

**5.4.1.17 GREEN\_RGB** `list GREEN_RGB = [0, 255, 0]`

**5.4.1.18 MAGENTA\_HEX** `int MAGENTA_HEX = 0xFF00FF`

**5.4.1.19 MAGENTA\_HUE** `int MAGENTA_HUE = 300`

**5.4.1.20 MAGENTA\_HUE\_RANGE** `list MAGENTA_HUE_RANGE = [260, 330]`

**5.4.1.21 MAGENTA\_RGB** `list MAGENTA_RGB = [255, 0, 255]`

**5.4.1.22 PASTEL\_BRIGHTNESS\_RANGE** `list PASTEL_BRIGHTNESS_RANGE = [50.0, 100.0]`

**5.4.1.23 PASTEL\_SATURATION\_RANGE** `list PASTEL_SATURATION_RANGE = [15.0, 75.0]`

**5.4.1.24 RED\_HEX** `int RED_HEX = 0xFF0000`

**5.4.1.25 RED\_HUE** `int RED_HUE = 0`

**5.4.1.26 RED\_HUE\_RANGE\_MAX** `list RED_HUE_RANGE_MAX = [330, 360]`

**5.4.1.27 RED\_HUE\_RANGE\_MIN** `list RED_HUE_RANGE_MIN = [0, 25]`

**5.4.1.28 RED\_RGB** `list RED_RGB = [255, 0, 0]`

**5.4.1.29 SATURATION\_RANGE** `list SATURATION_RANGE = [5.0, 100.0]`

**5.4.1.30 WHITE\_BRIGHTNESS\_RANGE** `list WHITE_BRIGHTNESS_RANGE = [75.0, 100.0]`

**5.4.1.31 WHITE\_HEX** `int WHITE_HEX = 0xFFFFFFFF`

**5.4.1.32 WHITE\_RGB** `list WHITE_RGB = [255, 255, 255]`

**5.4.1.33 YELLOW\_HEX** `int YELLOW_HEX = 0xFFEA00`

**5.4.1.34 YELLOW\_HUE** `int YELLOW_HUE = 55`

**5.4.1.35 YELLOW\_HUE\_RANGE** `list YELLOW_HUE_RANGE = [25, 64]`

**5.4.1.36 YELLOW\_RGB** `list YELLOW_RGB = [255, 234, 0]`



**Returns**

A HEX string.

**5.5.1.3 `hsv_to_rgb()`** `def hsv_to_rgb (`  
`hsv_array )`

Convert HSV array [h,s,v] to RGB array [r,g,b].

HSV where h is in the set [0, 359] and s, v are in the set [0.0, 100.0]. RGB where [r,g,b] are in the set [0, 255].  
Formula adapted from <https://www.rapidtables.com/convert/color/hsv-to-rgb.html>

**Parameters**

<i>hsv_array</i>	HSV array [h,s,v].
------------------	--------------------

**Returns**

RGB array [r,g,b].

**5.5.1.4 `rgb_to_hex()`** `def rgb_to_hex (`  
`rgb_array )`

Convert RGB array [r,g,b] to HEX string 'ffffff'.

RGB where [r,g,b] are in the set [0, 255]. HEX string is in the set ["000000", "ffffff"].

**Parameters**

<i>rgb_array</i>	RGB array [r,g,b].
------------------	--------------------

**Returns**

A HEX string.

**5.5.1.5 `rgb_to_hsv()`** `def rgb_to_hsv (`  
`rgb_array )`

Converts RGB array [r,g,b] to HSV array [h,s,v].

RGB where [r,g,b] are in the set [0, 255]. HSV where h is in the set [0, 359] and s, v are in the set [0.0, 100.0].  
Formula adapted from <https://www.rapidtables.com/convert/color/rgb-to-hsv.html>



## Parameters

<code>rgb_array</code>	RGB array [r,g,b].
------------------------	--------------------

## Returns

HSV array [h,s,v].

## 5.6 pypalex.extraction\_utils Namespace Reference

### Functions

- def [extract\\_ratios](#) (hsv\_img\_matrix\_2d)  
*Extracts the ratios of hues per pixel.*
- def [construct\\_base\\_color\\_dictionary](#) (hsv\_img\_matrix\_2d)  
*Constructs dictionary of base colors from an array of HSV pixel values.*
- def [extract\\_color\\_palettes](#) (base\_color\_dict, sat\_pref\_list)  
*Extracts dominant light, normal, dark color palettes from each of the base colors.*
- def [check\\_missing\\_colors](#) (base\_color\_dict, extracted\_colors\_dict)  
*Checks for any missing colors in the base color dictionary and borrows them from the surrounding colors.*
- def [generate\\_remaining\\_colors](#) (extracted\_colors\_dict, ratios)  
*Generate the remaining black and white, and background and foreground colors.*
- def [extract\\_color\\_types](#) (hsv\_base\_color\_matrix\_and\_sat\_prefs)  
*Extracts the dominant color types from a base color.*
- def [get\\_left\\_and\\_right\\_colors](#) (origin\_color\_name)  
*Gets the color names of the colors that are to the left and right of the originating color.*
- def [borrow\\_color](#) (extracted\_colors\_dict, origin, borrow\_left, borrow\_right)  
*Borrows a color from one of the extracted color types of the base colors.*
- def [get\\_dominant\\_hue](#) (extracted\_colors\_dict, ratios)  
*Calculates the dominant hue.*
- def [generate\\_black\\_and\\_white](#) (dominant\_hue)  
*Generates black and white color types using the dominant hue.*
- def [generate\\_background\\_and\\_foreground](#) (dominant\_hue, complementary\_hue)  
*Generates the background and foreground colors.*
- def [sort\\_by\\_bright\\_value](#) (hsv\_base\_color\_matrix)  
*Sorts the colors by the brightness value.*
- def [extract\\_dominant\\_color](#) (hsv\_color\_type\_matrix, sat\_pref)  
*Extracts the dominant color from a color type.*
- def [check\\_missing\\_color\\_types](#) (light\_color, norm\_color, dark\_color)  
*Checks to make sure all the color types have been properly set.*
- def [check\\_sat\\_and\\_bright](#) (hsv\_color)  
*Normalize saturation and brightness value.*
- def [calculate\\_centroid](#) (hsv\_color\_type\_matrix)  
*Calculates the centroid for a color type.*
- def [find\\_closest\\_to\\_centroid](#) (hsv\_color\_type\_matrix, centroid, sat\_pref)  
*Finds a color from a color type that is closest to the centroid.*

#### 5.6.1 Function Documentation

**5.6.1.1 borrow\_color()** `def borrow_color (`  
    `extracted_colors_dict,`  
    `origin,`  
    `borrow_left,`  
    `borrow_right )`

Borrows a color from one of the extracted color types of the base colors.

**Parameters**

<i>extracted_colors_dict</i>	A Dictionary of extracted colors.
<i>origin</i>	The name of the originating color.
<i>borrow_left</i>	The name of the color to borrow from, to the left of origin.
<i>borrow_right</i>	The name of the color to borrow from, to the right of origin.

**Returns**

A numpy array of a borrowed color.

**5.6.1.2 calculate\_centroid()** `def calculate_centroid (`  
    `hsv_color_type_matrix )`

Calculates the centroid for a color type.

The centroid is basically the average color of a set of colors in [h,s,v] format. The centroid is a point in 3-dimensional space. The following sources were used to make this algorithm: <http://mkweb.bcgsc.ca/color-summarizer/?faq#averagehue> and <https://stackoverflow.com/a/8170595/17047816>

**Parameters**

<i>hsv_color_type_matrix</i>	A 2D numpy array of a color type in [h,s,v] format.
------------------------------	---

**Returns**

List of centroid color values in [h,s,l] format.

**5.6.1.3 check\_missing\_color\_types()** `def check_missing_color_types (`  
    `light_color,`  
    `norm_color,`  
    `dark_color )`

Checks to make sure all the color types have been properly set.

If a color type is missing, then it will be derived from the existing color types.

## Parameters

<i>light_color</i>	A numpy array of a light color type in [h,s,v] format.
<i>norm_color</i>	A numpy array of a normal color type in [h,s,v] format.
<i>dark_color</i>	A numpy array of a dark color type in [h,s,v] format.

**5.6.1.4 check\_missing\_colors()** `def check_missing_colors (`  
     *base\_color\_dict*,  
     *extracted\_colors\_dict* )

Checks for any missing colors in the base color dictionary and borrows them from the surrounding colors.

## Parameters

<i>base_color_dict</i>	A dictionary of 2D numpy arrays for each of the base colors.
<i>extracted_colors_dict</i>	A Dictionary of extracted colors.

**5.6.1.5 check\_sat\_and\_bright()** `def check_sat_and_bright (`  
     *hsv\_color* )

Normalize saturation and brightness value.

The normalization process is to make sure that colors are visible, distinguishable and tolerable to look at. These ranges for saturation and brightness values are defined in [constants.py](#). This step can be removed if it is not needed as it does not impact the extraction process.

## Parameters

<i>hsv_color</i>	A numpy array of a color type in [h,s,v] format.
------------------	--

**5.6.1.6 construct\_base\_color\_dictionary()** `def construct_base_color_dictionary (`  
     *hsv\_img\_matrix\_2d* )

Constructs dictionary of base colors from an array of HSV pixel values.

Base colors are classified as [red, yellow, green, cyan, blue, magenta].

## Parameters

<i>hsv_img_matrix_2d</i>	A 2D numpy array of pixels from an image, in [h,s,v] format.
--------------------------	--

**Returns**

Dictionary of base colors.

**5.6.1.7 extract\_color\_palettes()** `def extract_color_palettes (`  
    *base\_color\_dict*,  
    *sat\_pref\_list* )

Extracts dominant light, normal, dark color palettes from each of the base colors.

**Parameters**

<i>base_color_dict</i>	A dictionary of 2D numpy arrays for each of the base colors.
<i>sat_pref_list</i>	List of saturation preference flags for light, normal, dark color palettes.

**Returns**

Dictionary of light, normal, dark color palettes for each of the base colors.

**5.6.1.8 extract\_color\_types()** `def extract_color_types (`  
    *hsv\_base\_color\_matrix\_and\_sat\_prefs* )

Extracts the dominant color types from a base color.

A color type is either a light, normal, or dark version of a base color.

**Parameters**

<i>hsv_base_color_matrix_and_sat_prefs</i>	A tuple of a 2D numpy array of a base color in [h,s,v] format and a list of saturation preference flags for light, normal, dark color palettes.
--	---

**Returns**

List of dominant numpy array color types in [h,s,v] format.

**5.6.1.9 extract\_dominant\_color()** `def extract_dominant_color (`  
    *hsv\_color\_type\_matrix*,  
    *sat\_pref* )

Extracts the dominant color from a color type.

A color type is either a light, normal, or dark version of a base color.

## Parameters

<i>hsv_color_type_matrix</i>	A 2D numpy array of a color type in [h,s,v] format. @para sat_pref A saturation preference flag for one of the light, normal, dark color palettes.
------------------------------	--

## Returns

A numpy array of a dominant color from a color type in [h,s,v] format.

**5.6.1.10 extract\_ratios()** `def extract_ratios (`  
     *hsv\_img\_matrix\_2d* `)`

Extracts the ratios of hues per pixel.

## Parameters

<i>hsv_img_matrix_2d</i>	A 2D numpy array of pixels from an image in [h,s,v] format.
--------------------------	---

## Returns

Dictionary of hue ratios (percentage) in set [0.0, 100.0]

**5.6.1.11 find\_closest\_to\_centroid()** `def find_closest_to_centroid (`  
     *hsv\_color\_type\_matrix*,  
     *centroid*,  
     *sat\_pref* `)`

Finds a color from a color type that is closest to the centroid.

The distance between the centroid color and each of the other individual colors is calculated in 3-dimensional space using the Euclidean Distance formula from the following sources: <https://stackoverflow.com/a/35114586/17047816> and <https://byjus.com/maths/distance-between-two-points-3d/>. Preference is given to saturated color when the sat\_pref parameter is set by using a parabola formula:  $f(x) = ((x - \text{point\_of\_symmetry\_of\_parabola}) / 6)^2$  where  $0 \leq x \leq 100$ . In this formula, x is our current saturation and point\_of\_symmetry\_of\_parabola is our preferred saturation. The source used to find and graph this formula: <https://www.graphfree.com/grapher.html>

## Note

Possible feature addition in the future, where the user can have the option to input their preferred saturation (e.g. pref\_sat) and it can be used to replace the point\_of\_symmetry\_of\_parabola in the parabola formula. If saturation is preferred (e.g. sat\_pref) but no preferred saturation is set by the user, then the default should be 60. And if saturation is not preferred, then that value should be set to None.

**Parameters**

<i>hsv_color_type_matrix</i>	A 2D numpy array of a color type in [h,s,v] format.
<i>centroid</i>	List of centroid color values in [h,s,l] format. @para sat_pref A saturation preference flag for one of the light, normal, dark color palettes.

**Returns**

List of all the colors in [h,s,v] format that are the shortest distance away from the centroid.

**5.6.1.12 generate\_background\_and\_foreground()** `def generate_background_and_foreground (`  
     *dominant\_hue*,  
     *complementary\_hue* )

Generates the background and foreground colors.

The background and foreground colors are based on the dominant hue in an image and it's complimentary hue. The saturation and brightness values for the background and foreground colors need to be hardcoded to be easier to look at.

**Parameters**

<i>dominant_hue</i>	The dominant hue of an image.
<i>complementary_hue</i>	The complimentary hue to the dominant hue.

**Returns**

Numpy array of light and dark background and foreground colors in [h,s,v] format.

**5.6.1.13 generate\_black\_and\_white()** `def generate_black_and_white (`  
     *dominant\_hue* )

Generates black and white color types using the dominant hue.

The saturation and brightness values, for the black and white color types, needs to be hardcoded in order to not interfere with the background and foreground colors.

**Parameters**

<i>dominant_hue</i>	The dominant hue of an image.
---------------------	-------------------------------

**Returns**

List of black and white color types in [h,s,v] format.

**5.6.1.14 generate\_remaining\_colors()** `def generate_remaining_colors (`  
    `extracted_colors_dict,`  
    `ratios )`

Generate the remaining black and white, and background and foreground colors.

#### Parameters

<i>extracted_colors_dict</i>	A Dictionary of extracted colors.
<i>ratios</i>	A Dictionary of ratios of the base colors in the image.

**5.6.1.15 get\_dominant\_hue()** `def get_dominant_hue (`  
    `extracted_colors_dict,`  
    `ratios )`

Calculates the dominant hue.

The dominant hue, also referred to as the average hue, is based on the color ratios and the colors extracted from an image.

#### Parameters

<i>extracted_colors_dict</i>	A Dictionary of extracted colors.
<i>ratios</i>	A Dictionary of ratios of the base colors in the image.

#### Returns

The dominant hue in an image.

**5.6.1.16 get\_left\_and\_right\_colors()** `def get_left_and_right_colors (`  
    `origin_color_name )`

Gets the color names of the colors that are to the left and right of the originating color.

There are two ways to think about left and right on a color wheel: from the inside looking outward and from the outside looking inward. This has an effect on how we think of the linear format of the color wheel. For this package we will think about left and right colors using the latter option.

#### Parameters

<i>origin_color_name</i>	The name of the originating color.
--------------------------	------------------------------------

#### Returns

List of color names that are to the left and right of the originating color.

**5.6.1.17 sort\_by\_bright\_value()** `def sort_by_bright_value (`  
`hsv_base_color_matrix )`

Sorts the colors by the brightness value.

A color type is either a light, normal, or dark version of a base color.

#### Parameters

<code>hsv_base_color_matrix</code>	A 2D numpy array of a base color in [h,s,v] format.
------------------------------------	---

#### Returns

List of numpy array color types in [h,s,v] format.

## 5.7 pypalex.Extractor Namespace Reference

### Classes

- class [Extractor](#)  
*Extracts colors given a matrix of HSV values extracted from an image.*

## 5.8 pypalex.file\_utils Namespace Reference

### Functions

- def [save\\_palette\\_to\\_file](#) (color\_palette, output\_filepath)  
*Saves color palette to json file.*
- def [save\\_default\\_scheme\\_to\\_file](#) (color\_palette, output\_filepath)  
*Saves color palette to json file as default color schemes.*

### 5.8.1 Function Documentation

**5.8.1.1 save\_default\_scheme\_to\_file()** `def save_default_scheme_to_file (`  
`color_palette,`  
`output_filepath )`

Saves color palette to json file as default color schemes.

Constructs 2 default color schemes, light and dark, using the color palettes and saves them to a json file.

#### Note

If a file with the same name already exists, it is overwritten.



## Parameters

<i>color_palette</i>	Dictionary of light, normal, and dark color palettes.
<i>output_filepath</i>	Output file path with filename of where to store color palette.

**5.8.1.2 save\_palette\_to\_file()** `def save_palette_to_file (`  
     *color\_palette*,  
     *output\_filepath* )

Saves color palette to json file.

## Note

If a file with the same name already exists, it is overwritten.

## Parameters

<i>color_palette</i>	Dictionary of light, normal, and dark color palettes.
<i>output_filepath</i>	Output file path with filename of where to store color palette.

## 5.9 pypalex.image\_utils Namespace Reference

### Functions

- def [process\\_image](#) (image)  
    *Processes PIL Image object.*
- def [rescale\\_image](#) (image)  
    *Rescales image to a smaller sampling size.*
- def [process\\_helper](#) (rgb\_matrix\_2d)  
    *Helper function for multiprocessing conversion operations.*

### 5.9.1 Function Documentation

**5.9.1.1 process\_helper()** `def process_helper (`  
     *rgb\_matrix\_2d* )

Helper function for multiprocessing conversion operations.

Helps convert from [r,g,b] to [h,s,v].

## Parameters

<i>rgb_matrix_2d</i>	A 2D matrix of rgb values.
----------------------	----------------------------

### 5.9.1.2 process\_image()

```
def process_image (
    image )
```

Multiprocessing example from: <https://stackoverflow.com/a/45555516>

## Parameters

<i>image</i>	PIL Image object.
--------------	-------------------

## Returns

### 5.9.1.3 `rescale_image()`

```
def rescale_image (
    image )
```

### Parameters

<i>image</i>	PIL Image object.
--------------	-------------------

## Returns

## 5.10 pypalex.print\_utils Namespace Reference

## Functions

- Generated by Doxygen

### 5.10.1 Function Documentation

**5.10.1.1 generate\_panes()** `def generate_panes (`  
    *background\_ansi\_color,*  
    *ansi\_colors1,*  
    *ansi\_colors2 )*

Generates panes based on two sets of ANSI color escape codes.

#### Note

The terminal needs to be able to display ASCII characters and ANSI colors for this to be useful.

#### Parameters

<i>background_ansi_color</i>	The background ANSI color escape code.
<i>ansi_colors1</i>	List of ANSI color escape codes.
<i>ansi_colors2</i>	List of ANSI color escape codes.

#### Returns

List of strings of panes with ASCII and ANSI escape codes.

**5.10.1.2 get\_ansi\_color\_codes()** `def get_ansi_color_codes (`  
    *rgb\_color\_palette )*

Constructs a ANSI escape code dictionary using a RGB [r,g,b] palette dictionary.

#### Parameters

<i>rgb_color_palette</i>	A dictionary of light, normal and dark color palettes in RGB [r,g,b] format.
--------------------------	--

#### Returns

A dictionary of ANSI color escape codes.

**5.10.1.3 get\_color\_escape()** `def get_color_escape (`  
    *rgb\_array,*  
    *background = False )*

Constructs ANSI color escape code based on an RGB list.

An RGB [r,g,b] list is used to generate an ANSI escape code of the RGB color for use in the terminal CLI. The basic format for these codes depends on if it will be used for foreground or background color. Use \033[38;2;r;g;b;bm for the foreground color. Use \033[48;2;r;g;b;bm for the background color.

**Note**

For more information about these ANSI escape codes, here are some sources: [https↵  
://stackoverflow.com/questions/4842424/list-of-ansi-color-escape-sequences/33206814#](https://stackoverflow.com/questions/4842424/list-of-ansi-color-escape-sequences/33206814#https://stackoverflow.com/questions/4842424/list-of-ansi-color-escape-sequences/33206814)  
<https://stackoverflow.com/questions/45782766/color-python-output-given-rrgbbb-hex-v>

**Parameters**

<i>rgb_array</i>	RGB array [r,g,b].
<i>background</i>	Flag for if the RGB color is for a background or not.

**Returns**

ANSI escape code of the RGB color.

**5.10.1.4 get\_rgb\_palette()** `def get_rgb_palette (`  
`hex_color_palette )`

Constructs an RGB [r,g,b] palette dictionary using a hex palette dictionary.

**Parameters**

<i>hex_color_palette</i>	A dictionary of color palettes in hex format.
--------------------------	---

**Returns**

A dictionary of colors in RGB [r,g,b] format.

**5.10.1.5 print\_default\_scheme\_preview()** `def print_default_scheme_preview (`  
`hex_color_palette )`

Prints the default color schemes to the terminal.

Prints a preview of the extracted color palettes to the user's terminal screen using ANSI escape codes.

**Note**

The terminal needs to be able to display ASCII characters and ANSI colors for this to work.

**Parameters**

<i>hex_color_palette</i>	A dictionary of light, normal, and dark color palettes in hex format.
--------------------------	---

## 6 Class Documentation

### 6.1 Extractor Class Reference

Extracts colors given a matrix of HSV values extracted from an image.

#### Public Member Functions

- `def __init__ (self, hsv\_img\_matrix\_2d, output\_filepath, pastel\_light=False, pastel\_normal=False, pastel\_dark=False, sat\_pref\_light=False, sat\_pref\_normal=False, sat\_pref\_dark=False)`  
*Extractor Constructor.*
- `def run (self)`  
*Main method for [Extractor](#) class.*
- `def check\_pastel\_conversion (self)`  
*Checks to see if any of the palettes should be converted to pastel.*
- `def construct\_palette\_dictionary (self)`  
*Constructs a dictionary of all the extracted color palettes in hex format.*
- `def construct\_scheme\_dictionary (self)`  
*Constructs a dictionary of color schemes by combining color palettes.*
- `def convert\_pastel\_light (self)`  
*Converts light palette to pastel.*
- `def convert\_pastel\_normal (self)`  
*Converts normal palette to pastel.*
- `def convert\_pastel\_dark (self)`  
*Converts dark palette to pastel.*
- `def convert\_pastel (self, hsv\_color)`  
*Converts/normalizes HSV color to pastel.*

#### Public Attributes

- [hsv\\_img\\_matrix\\_2d](#)  
*A 2D numpy array of pixels from an image in [h,s,v] format.*
- [output\\_filepath](#)  
*Output file path with filename of where to store color palette.*
- [pastel\\_light](#)  
*Flag to convert light color palette to pastel.*
- [pastel\\_normal](#)  
*Flag to convert normal color palette to pastel.*
- [pastel\\_dark](#)  
*Flag to convert dark color palette to pastel.*
- [sat\\_pref\\_list](#)  
*List of saturation preference flags for light, normal, dark color palettes.*
- [ratio\\_dict](#)  
*A dictionary that holds the ratio of base colors in an image and is used to identify the dominant color in an image.*
- [base\\_color\\_dict](#)  
*A dictionary of 2D numpy arrays for each of the 6 base colors.*
- [extracted\\_colors\\_dict](#)  
*A dictionary of extracted colors in [h,s,v] format.*
- [palette\\_dict](#)  
*A dictionary of light, normal, and dark color palettes in hex format.*

### 6.1.1 Detailed Description

Extracts colors given a matrix of HSV values extracted from an image.

### 6.1.2 Constructor & Destructor Documentation

**6.1.2.1 `__init__()`** `def __init__ (`  
`self,`  
`hsv_img_matrix_2d,`  
`output_filepath,`  
`pastel_light = False,`  
`pastel_normal = False,`  
`pastel_dark = False,`  
`sat_pref_light = False,`  
`sat_pref_normal = False,`  
`sat_pref_dark = False )`

[Extractor](#) Constructor.

#### Parameters

<i>self</i>	The object pointer.
<i>hsv_img_matrix_2d</i>	A 2D numpy array of pixels from an image in [h,s,v] format.
<i>output_filepath</i>	Output file path with filename of where to store color palette.
<i>pastel_light</i>	Flag to convert light color palette to pastel.
<i>pastel_normal</i>	Flag to convert normal color palette to pastel.
<i>pastel_dark</i>	Flag to convert dark color palette to pastel.
<i>sat_pref_light</i>	Flag that gives preference to more saturated colors of the light color palette.
<i>sat_pref_normal</i>	Flag that gives preference to more saturated colors of the normal color palette.
<i>sat_pref_dark</i>	Flag that gives preference to more saturated colors of the dark color palette.

### 6.1.3 Member Function Documentation

**6.1.3.1 `check_pastel_conversion()`** `def check_pastel_conversion (`  
`self )`

Checks to see if any of the palettes should be converted to pastel.

#### Parameters

<i>self</i>	The object pointer.
-------------	---------------------

**6.1.3.2 construct\_palette\_dictionary()** `def construct_palette_dictionary (`  
`self )`

Constructs a dictionary of all the extracted color palettes in hex format.

The extracted color palettes are organized in the dictionary as follows: light background, light foreground, dark background, dark foreground, light palette, normal palette, dark palette.

#### Parameters

<i>self</i>	The object pointer.
-------------	---------------------

**6.1.3.3 construct\_scheme\_dictionary()** `def construct_scheme_dictionary (`  
`self )`

Constructs a dictionary of color schemes by combining color palettes.

Light color scheme contains the normal and dark color palettes. Dark color scheme contains the normal and light color palettes.

#### Parameters

<i>self</i>	The object pointer.
-------------	---------------------

#### Returns

A dictionary of light and dark color schemes.

**6.1.3.4 convert\_pastel()** `def convert_pastel (`  
`self,`  
`hsv_color )`

Converts/normalizes HSV color to pastel.

For values x in range [a, b], values x can be converted to the new range [y, z] with the following equation:  $new\_x = (z-y) * ((x-a) / (b-a)) + y$

#### Parameters

<i>self</i>	The object pointer.
<i>hsv_color</i>	List HSV color to be converted to pastel.

**6.1.3.5 convert\_pastel\_dark()** `def convert_pastel_dark (`  
`self )`

Converts dark palette to pastel.

**Parameters**

<i>self</i>	The object pointer.
-------------	---------------------

**6.1.3.6 convert\_pastel\_light()** `def convert_pastel_light (`  
`self )`

Converts light palette to pastel.

**Parameters**

<i>self</i>	The object pointer.
-------------	---------------------

**6.1.3.7 convert\_pastel\_normal()** `def convert_pastel_normal (`  
`self )`

Converts normal palette to pastel.

**Parameters**

<i>self</i>	The object pointer.
-------------	---------------------

**6.1.3.8 run()** `def run (`  
`self )`

Main method for [Extractor](#) class.

Performs extraction of colors.

**Parameters**

<i>self</i>	The object pointer.
-------------	---------------------

## 6.1.4 Member Data Documentation



**6.1.4.1 base\_color\_dict** `base_color_dict`

A dictionary of 2D numpy arrays for each of the 6 base colors.

**6.1.4.2 extracted\_colors\_dict** `extracted_colors_dict`

A dictionary of extracted colors in [h,s,v] format.

**6.1.4.3 hsv\_img\_matrix\_2d** `hsv_img_matrix_2d`

A 2D numpy array of pixels from an image in [h,s,v] format.

**6.1.4.4 output\_filepath** `output_filepath`

Output file path with filename of where to store color palette.

**6.1.4.5 palette\_dict** `palette_dict`

A dictionary of light, normal, and dark color palettes in hex format.

**6.1.4.6 pastel\_dark** `pastel_dark`

Flag to convert dark color palette to pastel.

**6.1.4.7 pastel\_light** `pastel_light`

Flag to convert light color palette to pastel.

**6.1.4.8 pastel\_normal** `pastel_normal`

Flag to convert normal color palette to pastel.

#### 6.1.4.9 `ratio_dict` `ratio_dict`

A dictionary that holds the ratio of base colors in an image and is used to identify the dominant color in an image.

#### 6.1.4.10 `sat_pref_list` `sat_pref_list`

List of saturation preference flags for light, normal, dark color palettes.

The documentation for this class was generated from the following file:

- [Extractor.py](#)

## 7 File Documentation

### 7.1 `__main__.py` File Reference

Main script for PyPalEx.

#### Namespaces

- namespace [pypalex](#)  
*Python Palette [Extractor](#): extracts color palettes from images.*
- namespace [pypalex.\\_\\_main\\_\\_](#)

#### Functions

- def [main](#) ()  
*Main script function.*
- def [handle\\_args](#) ()  
*Handles the arguments passed to PyPalEx.*
- def [extract\\_color\\_palettes](#) ()  
*Handles color extraction from image(s).*
- def [setup\\_argument\\_parser](#) ()  
*Sets up the argument parser for command line arguments.*
- def [check\\_sources](#) (filepaths, path=None)  
*Checks each of the sources provided and removes any bad sources.*
- def [check\\_path](#) (path)  
*Check the path to make sure it exists.*
- def [set\\_global\\_args](#) (args)  
*Sets the global variables using the arguments.*
- def [check\\_source](#) (filepath)  
*Checks to make sure the path leads to a file.*

## Variables

- list `EXTRACTORS` = []  
*List of `Extractor` class objects for each individual image.*
- list `PROPER_IMAGES` = []  
*List of real/existing image file path(s).*
- list `FILENAMES` = []  
*List of image filenames.*
- list `OUTPUT_FILEPATHS` = []  
*List of output file path(s) for each image.*
- string `OUTPUT_PATH` = "  
*The path to the output directory where all JSON files will be saved.*
- string `OUTPUT_TAIL` = "-color\_palette.json"  
*The tail to append to each output filepath.*
- bool `SAVE_CHECK` = False  
*Flag to check if user wants to save extracted color palettes.*
- bool `SHOW_PREVIEW` = False  
*Flag to show a preview of extracted palettes.*
- bool `PASTEL_L` = False  
*Flag to convert light color palette to pastel.*
- bool `PASTEL_N` = False  
*Flag to convert normal color palette to pastel.*
- bool `PASTEL_D` = False  
*Flag to convert dark color palette to pastel.*
- bool `SAT_PREF_L` = False  
*Flag that gives preference to more saturated colors of the light color palette.*
- bool `SAT_PREF_N` = False  
*Flag that gives preference to more saturated colors of the normal color palette.*
- bool `SAT_PREF_D` = False  
*Flag that gives preference to more saturated colors of the dark color palette.*

### 7.1.1 Detailed Description

Main script for PyPalEx.

Used to run from the Command Line.

### 7.1.2 Author(s)

- Created by AI Timofeyev on February 2, 2022.
- Modified by AI Timofeyev on April 21, 2022.
- Modified by AI Timofeyev on March 6, 2023.
- Modified by AI Timofeyev on March 22, 2023.
- Modified by AI Timofeyev on March 26, 2023.
- Modified by AI Timofeyev on April 7, 2023.

## 7.2 `arg_messages.py` File Reference

Archive of messages to display for arguments supplied by user.

### Namespaces

- namespace [pypalex](#)  
*Python Palette [Extractor](#): extracts color palettes from images.*
- namespace [pypalex.arg\\_messages](#)

### Functions

- def [bad\\_source\\_message](#) ()  
*Generates an error message if the sources provided were not images.*
- def [bad\\_path\\_message](#) ()  
*Generates an error message if the directory provided is not a valid directory.*
- def [no\\_args\\_help\\_message](#) ()  
*Generates a help message if no arguments were presented.*

### 7.2.1 Detailed Description

Archive of messages to display for arguments supplied by user.

### 7.2.2 Author(s)

- Created by Al Timofeyev on March 3, 2022.
- Modified by Al Timofeyev on April 21, 2022.
- Modified by Al Timofeyev on March 6, 2023.

## 7.3 `constants.py` File Reference

A collection of constants for PyPalEx.

### Namespaces

- namespace [pypalex](#)  
*Python Palette [Extractor](#): extracts color palettes from images.*
- namespace [pypalex.constants](#)

## Variables

- list `BLACK_RGB` = [0, 0, 0]
- list `WHITE_RGB` = [255, 255, 255]
- list `RED_RGB` = [255, 0, 0]
- list `YELLOW_RGB` = [255, 234, 0]
- list `GREEN_RGB` = [0, 255, 0]
- list `CYAN_RGB` = [0, 255, 255]
- list `BLUE_RGB` = [0, 0, 255]
- list `MAGENTA_RGB` = [255, 0, 255]
- int `BLACK_HEX` = 0x000000
- int `WHITE_HEX` = 0xFFFFFF
- int `RED_HEX` = 0xFF0000
- int `YELLOW_HEX` = 0xFFEA00
- int `GREEN_HEX` = 0x00FF00
- int `CYAN_HEX` = 0x00FFFF
- int `BLUE_HEX` = 0x0000FF
- int `MAGENTA_HEX` = 0xFF00FF
- int `RED_HUE` = 0
- int `YELLOW_HUE` = 55
- int `GREEN_HUE` = 120
- int `CYAN_HUE` = 180
- int `BLUE_HUE` = 240
- int `MAGENTA_HUE` = 300
- list `RED_HUE_RANGE_MAX` = [330, 360]
- list `RED_HUE_RANGE_MIN` = [0, 25]
- list `YELLOW_HUE_RANGE` = [25, 64]
- list `GREEN_HUE_RANGE` = [64, 170]
- list `CYAN_HUE_RANGE` = [170, 210]
- list `BLUE_HUE_RANGE` = [210, 260]
- list `MAGENTA_HUE_RANGE` = [260, 330]
- list `BLACK_BRIGHTNESS_RANGE` = [0.0, 50.0]
- list `GRAY_BRIGHTNESS_RANGE` = [50.0, 75.0]
- list `WHITE_BRIGHTNESS_RANGE` = [75.0, 100.0]
- list `SATURATION_RANGE` = [5.0, 100.0]
- list `BRIGHTNESS_RANGE` = [25.0, 100.0]
- list `PASTEL_SATURATION_RANGE` = [15.0, 75.0]
- list `PASTEL_BRIGHTNESS_RANGE` = [50.0, 100.0]

### 7.3.1 Detailed Description

A collection of constants for PyPalEx.

### 7.3.2 Author(s)

- Created by Al Timofeyev on February 2, 2022.
- Modified by Al Timofeyev on April 21, 2022.
- Modified by Al Timofeyev on March 6, 2023.

## 7.4 conversion\_utils.py File Reference

Utilities for converting between RGB, HSV, HEX.

### Namespaces

- namespace [pypalex](#)  
*Python Palette [Extractor](#): extracts color palettes from images.*
- namespace [pypalex.conversion\\_utils](#)

### Functions

- def [rgb\\_to\\_hsv](#) (rgb\_array)  
*Converts RGB array [r,g,b] to HSV array [h,s,v].*
- def [hsv\\_to\\_hex](#) (hsv\_array)  
*Convert HSV array [h,s,v] to HEX string 'ffffff'.*
- def [hex\\_to\\_rgb](#) (hex\_str)  
*Convert HEX string 'ffffff' to RGB array [r,g,b].*
- def [hsv\\_to\\_rgb](#) (hsv\_array)  
*Convert HSV array [h,s,v] to RGB array [r,g,b].*
- def [rgb\\_to\\_hex](#) (rgb\_array)  
*Convert RGB array [r,g,b] to HEX string 'ffffff'.*

#### 7.4.1 Detailed Description

Utilities for converting between RGB, HSV, HEX.

#### 7.4.2 Author(s)

- Created by AI Timofeyev on February 2, 2022.
- Modified by AI Timofeyev on April 21, 2022.
- Modified by AI Timofeyev on March 6, 2023.
- Modified by AI Timofeyev on April 5, 2023.

## 7.5 extraction\_utils.py File Reference

Utilities for extracting colors from the image.

### Namespaces

- namespace [pypalex](#)  
*Python Palette [Extractor](#): extracts color palettes from images.*
- namespace [pypalex.extraction\\_utils](#)

## Functions

- def `extract_ratios` (hsv\_img\_matrix\_2d)  
*Extracts the ratios of hues per pixel.*
- def `construct_base_color_dictionary` (hsv\_img\_matrix\_2d)  
*Constructs dictionary of base colors from an array of HSV pixel values.*
- def `extract_color_palettes` (base\_color\_dict, sat\_pref\_list)  
*Extracts dominant light, normal, dark color palettes from each of the base colors.*
- def `check_missing_colors` (base\_color\_dict, extracted\_colors\_dict)  
*Checks for any missing colors in the base color dictionary and borrows them from the surrounding colors.*
- def `generate_remaining_colors` (extracted\_colors\_dict, ratios)  
*Generate the remaining black and white, and background and foreground colors.*
- def `extract_color_types` (hsv\_base\_color\_matrix\_and\_sat\_prefs)  
*Extracts the dominant color types from a base color.*
- def `get_left_and_right_colors` (origin\_color\_name)  
*Gets the color names of the colors that are to the left and right of the originating color.*
- def `borrow_color` (extracted\_colors\_dict, origin, borrow\_left, borrow\_right)  
*Borrows a color from one of the extracted color types of the base colors.*
- def `get_dominant_hue` (extracted\_colors\_dict, ratios)  
*Calculates the dominant hue.*
- def `generate_black_and_white` (dominant\_hue)  
*Generates black and white color types using the dominant hue.*
- def `generate_background_and_foreground` (dominant\_hue, complementary\_hue)  
*Generates the background and foreground colors.*
- def `sort_by_bright_value` (hsv\_base\_color\_matrix)  
*Sorts the colors by the brightness value.*
- def `extract_dominant_color` (hsv\_color\_type\_matrix, sat\_pref)  
*Extracts the dominant color from a color type.*
- def `check_missing_color_types` (light\_color, norm\_color, dark\_color)  
*Checks to make sure all the color types have been properly set.*
- def `check_sat_and_bright` (hsv\_color)  
*Normalize saturation and brightness value.*
- def `calculate_centroid` (hsv\_color\_type\_matrix)  
*Calculates the centroid for a color type.*
- def `find_closest_to_centroid` (hsv\_color\_type\_matrix, centroid, sat\_pref)  
*Finds a color from a color type that is closest to the centroid.*

### 7.5.1 Detailed Description

Utilities for extracting colors from the image.

### 7.5.2 Author(s)

- Created by AI Timofeyev on February 10, 2022.
- Modified by AI Timofeyev on April 21, 2022.
- Modified by AI Timofeyev on March 6, 2023.
- Modified by AI Timofeyev on March 22, 2023.
- Modified by AI Timofeyev on April 6, 2023.

## 7.6 `Extractor.py` File Reference

Extraction utility class for extracting colors from the image.

### Classes

- class [Extractor](#)  
*Extracts colors given a matrix of HSV values extracted from an image.*

### Namespaces

- namespace [pypalex](#)  
*Python Palette [Extractor](#): extracts color palettes from images.*
- namespace [pypalex.Extractor](#)

#### 7.6.1 Detailed Description

Extraction utility class for extracting colors from the image.

#### 7.6.2 Author(s)

- Created by AI Timofeyev on February 10, 2022.
- Modified by AI Timofeyev on April 21, 2022.
- Modified by AI Timofeyev on March 6, 2023.
- Modified by AI Timofeyev on March 22, 2023.
- Modified by AI Timofeyev on April 5, 2023.

## 7.7 `file_utils.py` File Reference

Utilities for file handling.

### Namespaces

- namespace [pypalex](#)  
*Python Palette [Extractor](#): extracts color palettes from images.*
- namespace [pypalex.file\\_utils](#)

### Functions

- def [save\\_palette\\_to\\_file](#) (color\_palette, output\_filepath)  
*Saves color palette to json file.*
- def [save\\_default\\_scheme\\_to\\_file](#) (color\_palette, output\_filepath)  
*Saves color palette to json file as default color schemes.*



### 7.7.1 Detailed Description

Utilities for file handling.

#### Note

Potential point for contributors to add different output saving options.

### 7.7.2 Author(s)

- Created by AI Timofeyev on April 5, 2023.

## 7.8 image\_utils.py File Reference

Utilities for processing image and file handling.

### Namespaces

- namespace [pypalex](#)  
*Python Palette [Extractor](#): extracts color palettes from images.*
- namespace [pypalex.image\\_utils](#)

### Functions

- def [process\\_image](#) (image)  
*Processes PIL Image object.*
- def [rescale\\_image](#) (image)  
*Rescales image to a smaller sampling size.*
- def [process\\_helper](#) (rgb\_matrix\_2d)  
*Helper function for multiprocessing conversion operations.*

### 7.8.1 Detailed Description

Utilities for processing image and file handling.

### 7.8.2 Author(s)

- Created by AI Timofeyev on February 27, 2022.
- Modified by AI Timofeyev on April 21, 2022.
- Modified by AI Timofeyev on March 6, 2023.
- Modified by AI Timofeyev on April 5, 2023.

## 7.9 print\_utils.py File Reference

Utilities for printing preview to the screen.

### Namespaces

- namespace [pypalex](#)  
*Python Palette [Extractor](#): extracts color palettes from images.*
- namespace [pypalex.print\\_utils](#)

### Functions

- def [print\\_default\\_scheme\\_preview](#) (hex\_color\_palette)  
*Prints the default color schemes to the terminal.*
- def [get\\_color\\_escape](#) (rgb\_array, background=False)  
*Constructs ANSI color escape code based on an RGB list.*
- def [get\\_rgb\\_palette](#) (hex\_color\_palette)  
*Constructs an RGB [r,g,b] palette dictionary using a hex palette dictionary.*
- def [get\\_ansi\\_color\\_codes](#) (rgb\_color\_palette)  
*Constructs a ANSI escape code dictionary using a RGB [r,g,b] palette dictionary.*
- def [generate\\_panes](#) (background\_ansi\_color, ansi\_colors1, ansi\_colors2)  
*Generates panes based on two sets of ANSI color escape codes.*

### 7.9.1 Detailed Description

Utilities for printing preview to the screen.

#### Note

Potential point for contributors to add different printing options, maybe even a printing option that displays in a GUI.

### 7.9.2 Author(s)

- Created by Al Timofeyev on April 5, 2023.

## Index

- `__init__`
    - Extractor, 28
  - `__main__.py`, 32
- `arg_messages.py`, 34
- `bad_path_message`
  - `pypalex.arg_messages`, 8
- `bad_source_message`
  - `pypalex.arg_messages`, 8
- `base_color_dict`
  - Extractor, 30
- `BLACK_BRIGHTNESS_RANGE`
  - `pypalex.constants`, 9
- `BLACK_HEX`
  - `pypalex.constants`, 9
- `BLACK_RGB`
  - `pypalex.constants`, 9
- `BLUE_HEX`
  - `pypalex.constants`, 10
- `BLUE_HUE`
  - `pypalex.constants`, 10
- `BLUE_HUE_RANGE`
  - `pypalex.constants`, 10
- `BLUE_RGB`
  - `pypalex.constants`, 10
- `borrow_color`
  - `pypalex.extraction_utils`, 15
- `BRIGHTNESS_RANGE`
  - `pypalex.constants`, 10
- `calculate_centroid`
  - `pypalex.extraction_utils`, 16
- `check_missing_color_types`
  - `pypalex.extraction_utils`, 16
- `check_missing_colors`
  - `pypalex.extraction_utils`, 17
- `check_pastel_conversion`
  - Extractor, 28
- `check_path`
  - `pypalex.__main__`, 4
- `check_sat_and_bright`
  - `pypalex.extraction_utils`, 17
- `check_source`
  - `pypalex.__main__`, 4
- `check_sources`
  - `pypalex.__main__`, 5
- `constants.py`, 34
- `construct_base_color_dictionary`
  - `pypalex.extraction_utils`, 17
- `construct_palette_dictionary`
  - Extractor, 28
- `construct_scheme_dictionary`
  - Extractor, 29
- `conversion_utils.py`, 36
- `convert_pastel`
  - Extractor, 29
- `convert_pastel_dark`
  - Extractor, 29
- `convert_pastel_light`
  - Extractor, 30
- `convert_pastel_normal`
  - Extractor, 30
- `CYAN_HEX`
  - `pypalex.constants`, 10
- `CYAN_HUE`
  - `pypalex.constants`, 10
- `CYAN_HUE_RANGE`
  - `pypalex.constants`, 10
- `CYAN_RGB`
  - `pypalex.constants`, 10
- `extract_color_palettes`
  - `pypalex.__main__`, 5
  - `pypalex.extraction_utils`, 18
- `extract_color_types`
  - `pypalex.extraction_utils`, 18
- `extract_dominant_color`
  - `pypalex.extraction_utils`, 18
- `extract_ratios`
  - `pypalex.extraction_utils`, 19
- `extracted_colors_dict`
  - Extractor, 31
- `extraction_utils.py`, 36
- Extractor, 27
  - `__init__`, 28
  - `base_color_dict`, 30
  - `check_pastel_conversion`, 28
  - `construct_palette_dictionary`, 28
  - `construct_scheme_dictionary`, 29
  - `convert_pastel`, 29
  - `convert_pastel_dark`, 29
  - `convert_pastel_light`, 30
  - `convert_pastel_normal`, 30
  - `extracted_colors_dict`, 31
  - `hsv_img_matrix_2d`, 31
  - `output_filepath`, 31
  - `palette_dict`, 31
  - `pastel_dark`, 31
  - `pastel_light`, 31
  - `pastel_normal`, 31
  - `ratio_dict`, 31
  - `run`, 30
  - `sat_pref_list`, 32
- `Extractor.py`, 38
- EXTRACTORS
  - `pypalex.__main__`, 6
- `file_utils.py`, 38
- FILENAMES
  - `pypalex.__main__`, 6
- `find_closest_to_centroid`

- pypalex.extraction\_utils, 19
- generate\_background\_and\_foreground
  - pypalex.extraction\_utils, 20
- generate\_black\_and\_white
  - pypalex.extraction\_utils, 20
- generate\_panes
  - pypalex.print\_utils, 25
- generate\_remaining\_colors
  - pypalex.extraction\_utils, 20
- get\_ansi\_color\_codes
  - pypalex.print\_utils, 25
- get\_color\_escape
  - pypalex.print\_utils, 25
- get\_dominant\_hue
  - pypalex.extraction\_utils, 21
- get\_left\_and\_right\_colors
  - pypalex.extraction\_utils, 21
- get\_rgb\_palette
  - pypalex.print\_utils, 26
- GRAY\_BRIGHTNESS\_RANGE
  - pypalex.constants, 10
- GREEN\_HEX
  - pypalex.constants, 10
- GREEN\_HUE
  - pypalex.constants, 11
- GREEN\_HUE\_RANGE
  - pypalex.constants, 11
- GREEN\_RGB
  - pypalex.constants, 11
- handle\_args
  - pypalex.\_\_main\_\_, 5
- hex\_to\_rgb
  - pypalex.conversion\_utils, 13
- hsv\_img\_matrix\_2d
  - Extractor, 31
- hsv\_to\_hex
  - pypalex.conversion\_utils, 13
- hsv\_to\_rgb
  - pypalex.conversion\_utils, 14
- image\_utils.py, 39
- MAGENTA\_HEX
  - pypalex.constants, 11
- MAGENTA\_HUE
  - pypalex.constants, 11
- MAGENTA\_HUE\_RANGE
  - pypalex.constants, 11
- MAGENTA\_RGB
  - pypalex.constants, 11
- main
  - pypalex.\_\_main\_\_, 5
- no\_args\_help\_message
  - pypalex.arg\_messages, 8
- output\_filepath
  - Extractor, 31
- OUTPUT\_FILEPATHS
  - pypalex.\_\_main\_\_, 6
- OUTPUT\_PATH
  - pypalex.\_\_main\_\_, 6
- OUTPUT\_TAIL
  - pypalex.\_\_main\_\_, 6
- palette\_dict
  - Extractor, 31
- PASTEL\_BRIGHTNESS\_RANGE
  - pypalex.constants, 11
- PASTEL\_D
  - pypalex.\_\_main\_\_, 6
- pastel\_dark
  - Extractor, 31
- PASTEL\_L
  - pypalex.\_\_main\_\_, 7
- pastel\_light
  - Extractor, 31
- PASTEL\_N
  - pypalex.\_\_main\_\_, 7
- pastel\_normal
  - Extractor, 31
- PASTEL\_SATURATION\_RANGE
  - pypalex.constants, 11
- print\_default\_scheme\_preview
  - pypalex.print\_utils, 26
- print\_utils.py, 40
- process\_helper
  - pypalex.image\_utils, 23
- process\_image
  - pypalex.image\_utils, 24
- PROPER\_IMAGES
  - pypalex.\_\_main\_\_, 7
- pypalex, 3
- pypalex.\_\_main\_\_, 3
  - check\_path, 4
  - check\_source, 4
  - check\_sources, 5
  - extract\_color\_palettes, 5
- EXTRACTORS, 6
- FILENAMES, 6
- handle\_args, 5
- main, 5
- OUTPUT\_FILEPATHS, 6
- OUTPUT\_PATH, 6
- OUTPUT\_TAIL, 6
- PASTEL\_D, 6
- PASTEL\_L, 7
- PASTEL\_N, 7
- PROPER\_IMAGES, 7
- SAT\_PREF\_D, 7
- SAT\_PREF\_L, 7
- SAT\_PREF\_N, 7
- SAVE\_CHECK, 7
- set\_global\_args, 5
- setup\_argument\_parser, 6
- SHOW\_PREVIEW, 7
- pypalex.arg\_messages, 8

- bad\_path\_message, 8
- bad\_source\_message, 8
- no\_args\_help\_message, 8
- pypalex.constants, 9
  - BLACK\_BRIGHTNESS\_RANGE, 9
  - BLACK\_HEX, 9
  - BLACK\_RGB, 9
  - BLUE\_HEX, 10
  - BLUE\_HUE, 10
  - BLUE\_HUE\_RANGE, 10
  - BLUE\_RGB, 10
  - BRIGHTNESS\_RANGE, 10
  - CYAN\_HEX, 10
  - CYAN\_HUE, 10
  - CYAN\_HUE\_RANGE, 10
  - CYAN\_RGB, 10
  - GRAY\_BRIGHTNESS\_RANGE, 10
  - GREEN\_HEX, 10
  - GREEN\_HUE, 11
  - GREEN\_HUE\_RANGE, 11
  - GREEN\_RGB, 11
  - MAGENTA\_HEX, 11
  - MAGENTA\_HUE, 11
  - MAGENTA\_HUE\_RANGE, 11
  - MAGENTA\_RGB, 11
  - PASTEL\_BRIGHTNESS\_RANGE, 11
  - PASTEL\_SATURATION\_RANGE, 11
  - RED\_HEX, 11
  - RED\_HUE, 11
  - RED\_HUE\_RANGE\_MAX, 12
  - RED\_HUE\_RANGE\_MIN, 12
  - RED\_RGB, 12
  - SATURATION\_RANGE, 12
  - WHITE\_BRIGHTNESS\_RANGE, 12
  - WHITE\_HEX, 12
  - WHITE\_RGB, 12
  - YELLOW\_HEX, 12
  - YELLOW\_HUE, 12
  - YELLOW\_HUE\_RANGE, 12
  - YELLOW\_RGB, 12
- pypalex.conversion\_utils, 13
  - hex\_to\_rgb, 13
  - hsv\_to\_hex, 13
  - hsv\_to\_rgb, 14
  - rgb\_to\_hex, 14
  - rgb\_to\_hsv, 14
- pypalex.extraction\_utils, 15
  - borrow\_color, 15
  - calculate\_centroid, 16
  - check\_missing\_color\_types, 16
  - check\_missing\_colors, 17
  - check\_sat\_and\_bright, 17
  - construct\_base\_color\_dictionary, 17
  - extract\_color\_palettes, 18
  - extract\_color\_types, 18
  - extract\_dominant\_color, 18
  - extract\_ratios, 19
  - find\_closest\_to\_centroid, 19
  - generate\_background\_and\_foreground, 20
  - generate\_black\_and\_white, 20
  - generate\_remaining\_colors, 20
  - get\_dominant\_hue, 21
  - get\_left\_and\_right\_colors, 21
  - sort\_by\_bright\_value, 21
- pypalex.Extractor, 22
- pypalex.file\_utils, 22
  - save\_default\_scheme\_to\_file, 22
  - save\_palette\_to\_file, 23
- pypalex.image\_utils, 23
  - process\_helper, 23
  - process\_image, 24
  - rescale\_image, 24
- pypalex.print\_utils, 24
  - generate\_panes, 25
  - get\_ansi\_color\_codes, 25
  - get\_color\_escape, 25
  - get\_rgb\_palette, 26
  - print\_default\_scheme\_preview, 26
- ratio\_dict
  - Extractor, 31
- RED\_HEX
  - pypalex.constants, 11
- RED\_HUE
  - pypalex.constants, 11
- RED\_HUE\_RANGE\_MAX
  - pypalex.constants, 12
- RED\_HUE\_RANGE\_MIN
  - pypalex.constants, 12
- RED\_RGB
  - pypalex.constants, 12
- rescale\_image
  - pypalex.image\_utils, 24
- rgb\_to\_hex
  - pypalex.conversion\_utils, 14
- rgb\_to\_hsv
  - pypalex.conversion\_utils, 14
- run
  - Extractor, 30
- SAT\_PREF\_D
  - pypalex.\_\_main\_\_, 7
- SAT\_PREF\_L
  - pypalex.\_\_main\_\_, 7
- sat\_pref\_list
  - Extractor, 32
- SAT\_PREF\_N
  - pypalex.\_\_main\_\_, 7
- SATURATION\_RANGE
  - pypalex.constants, 12
- SAVE\_CHECK
  - pypalex.\_\_main\_\_, 7
- save\_default\_scheme\_to\_file
  - pypalex.file\_utils, 22
- save\_palette\_to\_file
  - pypalex.file\_utils, 23
- set\_global\_args

- `pypalex.__main__`, [5](#)
- `setup_argument_parser`
  - `pypalex.__main__`, [6](#)
- `SHOW_PREVIEW`
  - `pypalex.__main__`, [7](#)
- `sort_by_bright_value`
  - `pypalex.extraction_utils`, [21](#)
- 
- `WHITE_BRIGHTNESS_RANGE`
  - `pypalex.constants`, [12](#)
- `WHITE_HEX`
  - `pypalex.constants`, [12](#)
- `WHITE_RGB`
  - `pypalex.constants`, [12](#)
- 
- `YELLOW_HEX`
  - `pypalex.constants`, [12](#)
- `YELLOW_HUE`
  - `pypalex.constants`, [12](#)
- `YELLOW_HUE_RANGE`
  - `pypalex.constants`, [12](#)
- `YELLOW_RGB`
  - `pypalex.constants`, [12](#)